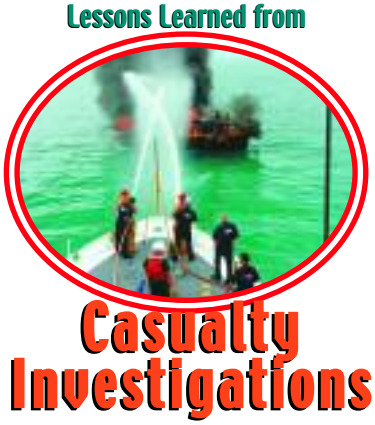
Fire in the Engine Room

Many events led to fire and subsequent casualties.



by Ms. Betty Lynn Sprinkle
Special Correspondent to *Proceedings*

The SSG *Edward A. Carter, Jr.* was a containership chartered by the Military Sealift Command to transport explosive cargo as part of its Prepositioning Program for the U.S. Army. Purchased in late February of 2001 by Maersk Line Ltd., the ship was in drydock at the Norfolk Shipyard Company (Norshipco) in Norfolk, Va. until mid-June of 2001. While there, the ship renewed its hull and machinery classification certificates and Certificate of Inspection and upgraded its cargo handling equipment. It departed Norshipco early on the morning of June 13 and arrived at the Military Ocean Terminal, Sunny Point (MOTSU) the following day. By the middle of July, the vessel was loaded with 1,212 containers of Class 1 explosives, holding a total net explosive weight of five million pounds. The vessel was to complete loading Class 1 explosives before departing the south wharf of the MOTSU at the end of July. Its intended destination was the island of Diego Garcia in the Indian Ocean.

The Event

On Saturday, July 14, 2001, all the engineers except the chief engineer went to the engine control room for a mid-afternoon break. The wiper left around 3:30 p.m. to return to the second level to work. The first assistant engineer and electrician stayed in the control room. The second assistant engineer began a transfer of heavy fuel oil (HFO) from tanks within the engine room.

The heavy fuel oil began to spill over the HFO settling tanks, into the vent piping. The HFO flowed along the common vent piping and into the main engine mixing tank, which holds diesel oil. Continuing to flow, the mixed HFO and diesel oil spilled onto the first level and covered the solid deck plating. Eventually the combined fuels spilled over the first level deck coaming and onto the auxiliary boiler exhaust stack. The exhaust stack was hot enough to ignite the fuels. The resulting fire sent intense heat, black smoke, and flame through the aft levels of the engine room and inside the fidley. The diesel and heavy fuel oil mixture

Residual oil on deck in the vicinity of the incinerator exhaust stack of the 03 level of the engine room. Fire damage is visible in the surrounding area. USCG Photo.

continued to cascade down from the first level and second deck raining fire onto the third platform level.

At one minute after four, the fire detection alarm sounded. The first assistant engineer checked the smoke detection panel to find five separate zone indicator lights active. He silenced the alarm and, along with the electrician, went to the generator room on the

third platform level, where they saw thick smoke pouring out. They quickly returned to the engine control room and called the master to report the fire. The master proceeded to the bridge to energize the starboard fire pump. After waiting for pressure to develop in the piping system, he left the bridge and went to the starboard main deck gangway phone to call MOTSU security.

When the second assistant engineer heard the fire alarm, he went to the engine room to check and saw smoke and fire coming from the auxiliary boiler. He observed material falling down from the base of the boiler.

Assumptions and Actions

Thinking that a broken diesel fuel line was the cause of the fire, the electrician attempted to extinguish the flames at the base of the boiler with a dry chemical extinguisher, but it was no match for the flames and smoke pouring down from above. He looked up to discover the electrical cable rack above him was on fire. Next he heard a loud "whoosh" and saw dense smoke. He heard a call to evacuate the engine room and ran through thick smoke, up the starboard side ladder to the forward engine room catwalk. At the same time, both the first and second assistant engineers left the engine room.

Five-inch drain line from the HFO fuel tank vent collection chamber on the 03 level of the engine room. USCG Photo.

The electrician and second assistant engineer were sent to the fire control room to shut down the ventilation fans and fuel pumps and close the emergency fuel valves. The electrician shut down the fuel pumps and ventilation fans and closed the emergency fuel valves attached to each of the HFO and diesel oil storage and service tanks.

The third mate attempted to enter the engine room to investigate the source and location of the fire. The electrician and an AB were both outfitted with self-contained breathing apparatus (SCBA). They tried to get to the engine room through the fire door in the elevator room on the second deck, but were prevented from doing so by heavy smoke and intense heat.

When the chief mate heard the alarm, he went down to the starboard ladder to repair locker #2 and told the chief cook and chief steward to dress out in firemen's outfits. The chief mate ordered the second mate to take charge of the response team on the 03 level. When the second mate reached the 03 passageway, he found heavy smoke and intense heat. He saw smoke escaping from three sides of the fire door, which leads from the galley into the fidley.

When the chief mate got to the fire control room, he found that neither the main nor the emergency fire pump had been operating. He did not see any of the valves or pump lights energized on the fire control panel. He instructed the first assistant engineer to get the emergency generator on-line. The generators started working shortly thereafter.

The chief steward, chief cook, and steward assistant dressed out in fire suits and SCBAs and began to water the door leading from the 03 level into the fidley with two fire hoses. The group attempted to open the fire door leading into the fidley but the heat was too intense for safety. As the smoke increased in that area, the second mate ordered the team to evacuate.

After evacuating the 03 level, the second mate went to the bridge to start the starboard fire pump and access the bridge level repair locker. He then opened the port bridge wing fire station valve to provide water to cool the exterior of the exhaust stack. While his attempt to put water in the exhaust fan vent louvers failed, the second mate was able to cool the stack externally. He then attempted to close the two exhaust fan fire dampers but the smoke made this impossible. After dressing out in a fireman's uniform and SCBA, he succeeded in closing one of the two vents.

Firefighters Arrive

At this point, the chief mate directed the boatswain to assist with getting a gangway placed from the pier to the opened starboard sideport door to assist the shoreside fire team with direct access to the engine room.

Firefighters from the MOTSU fire department arrived at 4:10 p.m. and by 4:20 were onboard. They met the master near the gangway and attempted to get a muster and a summary of the fire response actions by the crew. The firefighters recommended

the master use the fixed CO_2 system to help battle the fire. They then heard someone might be in the engine room. As the firemen were in fire suits and SCBAs, they entered the engine room to determine the location of the fire and attempt to rescue the missing person. The heat and smoke were too intense even with protective gear and they returned to the main deck.

Man Overboard

At this point, the first assistant engineer heard someone report cries for help. He looked over the port side and saw the wiper in the Cape Fear River near the port sideport door. The first assistant engineer ran to the port side main deck and tossed a ring buoy into the water. The wiper could not reach the ring buoy and it drifted away from him. The first assistant engineer walked forward on the main deck to follow the wiper and tossed another ring buoy with a line attached three separate times. The wiper was struggling in the water and made several attempts to reach the ring buoy but was unable to do so. The first assistant engineer saw the wiper stop treading water and fall beneath the surface of the water. He told one of the firefighters that the wiper was in the water and to call for assistance. Within three minutes of seeing the wiper sink, the first assistant engineer saw a Coast Guard utility boat approach the ship. He yelled to the boat crew to show them where he last saw the wiper.

CO_2 System Unresponsive, Low Water Pressure

The first assistant engineer then went down to the port mooring deck and was ordered by the master to release the fixed CO_2 system. He and the electrician donned SCBAs and entered the port pipe tunnel to access the fire control room together. They attempted to release the CO_2 that protects the engine room spaces by opening the two master control valves. The heavy smoke prohibited them from seeing the small "pony" bottle cylinder valves that needed to be opened to activate the system. The electrician reported to the master that they were unsuccessful in releasing the CO_2.

With additional instructions from the master, the electrician and the third mate attempted to activate the system from the CO_2 room. Two MOTSU firefighters went with them in the second attempt to activate the system. Smoke in the CO_2 room was even more intense than in the fire control room. They heard sounds and saw a change in the smoke, which they thought indicated that the CO_2 was released; later investigations showed that it was not.

Open discharge valve from HFO (Heavy fuel oil) transfer pump in the lower level of the engine room. Oil and fire damage is visible. USCG Photo.

Six firefighters took two charged hoses through the open starboard sideport door into the engine room. Shoreside fire hoses were charged by fire trucks located on the wharf and were supplied from nearby fire hydrants. The shoreside fire teams did not use any of the ship's fire hoses because pressure was too low.

Two teams of firefighters used a water and foam mixture to cool the hot spots located below the main engine in the aft sections of the engine room. About 1300 gallons of aqueous film forming foam, collected from local fire department inventories, was used to fight the engine room fire.

Evacuation

When crew members reported the emergency generators were not working and they had no water pressure to fight the fires, the shoreside firefighters ordered the crew to evacuate the ship. By then enough firefighters and equipment were on the pier to take over the firefighting duties. All told, 150 firefighters from 30 surrounding county and city fire departments responded to the fire, providing personnel support and equipment. The fire crews were successful in containing the fire to the aft sections of the engine room and preventing the heat and fire from spreading into the cargo, with its five million pounds of explosive materials.

Within six hours, the fire was under control and within 10 hours, it was completely extinguished. The 32-foot fire boat from the Wilmington Fire Department arrived on the scene at about 6:20 p.m. and personnel used its fire monitor to cool the sideshell plating on the port side of the engine room space. A 107-foot tug operated by MOTSU arrived

two hours later, at approximately 8:20 p.m. The tug's crew directed the three fire monitors to cool the aft end of the engine room exhaust stack above the main deck. The fire was mostly confined within the engine room, preventing the fire tugs from having a direct impact on the fire.

After the shoreside firefighters had been working on the fire for about an hour and a half, a thermal imaging camera from a volunteer fire department was brought on board to assist their efforts. The camera revealed hot spots to the two fire teams, allowing them to attack the fire and move further aft. The camera identified the highest concentration of heat right below the main engine, on the third platform level. The fire was under control by 10:00 p.m. and entirely out by 1:30 a.m. on July 15.

Total damage to the ship was estimated at $15 million dollars. Two lives were lost in this incident. The third assistant engineer died of smoke inhalation and the wiper drowned in the Cape Fear River. The third assistant engineer was working on the third level deck when the fire broke out. The coroner's report stated that he died of smoke inhalation. The wiper apparently jumped out the sideport door to flee the fire and was unable to tread water or to swim to the two life rings that were cast to him. The Coast Guard vessel was unable to find the wiper in the river.

Contributing Factors

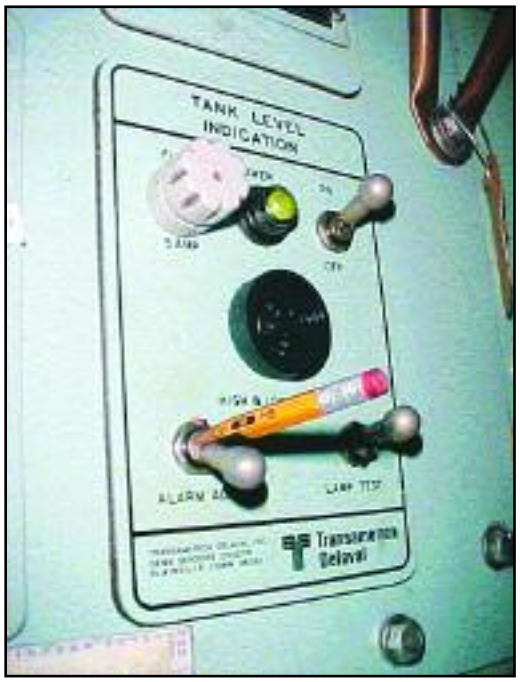
Several situations contributed to the cause of the fire and complicated its containment. A device that monitors the storage tank overflow had been malfunctioning for several weeks, causing false alarms. The alarms had been disabled and did not alert the crew that the storage tanks were overfull. The engineers knew about this situation, but did not attempt to repair it, nor did they alert the master to the situation. These actions bypassed critical safety features of the system.

The engineers disconnected a venting pipe for maintenance two days prior to the fire and it was not reconnected before starting the transfer of fuel. No warnings were placed to prevent using the HFO transfer pumps while the vent was disconnected. The engineers failed to trace the lines they were disconnecting or to notify the master that they were performing such maintenance. A great deal of damage from the fire was found in the area where the disconnected vent pipes were located.

The heavy smoke that accompanied the fire prevented access to some of the firefighting equipment on board and also hindered efforts to extinguish the fire. While the steward crew members followed their fire drill instructions, the engineering crew could not meet at their designated place because of smoke. This crew was not prepared with an alternate course of action.

Two sideport doors on the vessel were left open for ventilation and, consequently, did not contain the fire within the engine control room. On the plus side, these doors provided direct access to the engine room for the shoreside firefighters to attack the fire.

The master delayed orders to use the low-pressure CO_2 fire suppression system, which might have suppressed the fire much earlier. While crew members made two attempts to activate the fire suppression system, apparently the CO_2 was never released. The release of the system is dependent on electrical power, which is often unavailable in a fire emergency. The system also required a three-step process to activate, which crew members found awkward to implement. Finally, even though instructions for activating the system were displayed, the heavy smoke coming from the fire made reading and following those instructions impossible. The open sideport doors would have made the CO_2 system less effective in suppressing the fire because of a lack of containment.



A pencil wedged into the High Tank Level Indicator audible alarm panel. Position of pencil holds switch in "Acknoweldge" position. The alarm would never sound to warn of a high tank level when the switch was in this position. USCG Photo.

Despite having held a fire drill the very morning of the fire, testimony at the investigation revealed many crew members did not follow their prescribed activities or report to their designated stations. A general failure

Fire damage to equipment and gear on the 03 level of the engine room. USCG Photo.

of leadership during the crisis contributed to confusion and delays in dealing with the fire. The failure of the master to muster the personnel may have delayed rescue attempts for the third assistant engineer. While local firefighting support arrived quickly to the *Carter*, the fire tug from MOTSU took three hours to reach the site.

Recommendations Made and Actions Taken by the Coast Guard

As a result of this incident, the investigating officer recommended 13 items for maintaining safety and preserving lives aboard vessels of this nature. Those recommendations included:

- American Bureau of Shipping training programs to keep surveyors familiar with fixed firefighting systems (especially the low-pressure CO_2 systems);
- that vessels with sideport doors that form part of the hull, have the ability to close from remote positions;
- the MOTSU fire brigade obtain a thermal imaging camera to locate hot spots in vessels in port;
- the USCG Marine Safety Office in Wilmington and MOTSU work to reduce the response time for MOTSU's fire tug from four hours to one;
- that appropriate offices determine which ships still use the low-pressure CO_2 systems and notify the owners of the potential problems with them.

Actions Taken:

In response to this incident the following actions have been taken:

- Modifications to the surveyor's instructions for vessels of this type have been presented.
- The *SSG Carter* has installed a system to close the sideport doors remotely.
- The MOTSU fire brigade obtained a thermal imaging camera.
- The Marine Safety Office and MOTSU have reduced the response time for the fire tug from four hours to one.
- The Coast Guard issued a safety alert in March 2002 concerning problems with low-pressure CO_2 systems and notified owners of similar class vessels of potential problems with the system.

Disciplinary actions taken

The second assistant engineer agreed to a two-year suspension of his license and agreed to undertake additional firefighting training. The chief engineer had his license revoked for misconduct. There was no action taken against the master.

Lesson Learned

While the untended transfer of fuel oil is the primary cause of this casualty, many factors contributed to the engine room fire and subsequent events. The method of dealing with the tank level indicator and false alarms prevented personnel from having accurate information about the storage tanks. A lesson to be learned from this is that alarm and safety devices are placed in systems for a purpose, and engineers and crew bypass them at their peril.

Despite having documented reviews of procedures, many of the ship's crew failed to attend to their required duties or man their stations during the fire emergency. A general lack of leadership by the master delayed appropriate responses. Fire drills and training need to be taken seriously and held frequently. Crew members need to be familiar with their duties during a crisis and able to perform them without fail.

About the author: *Ms. Betty Lynn Sprinkle is a free-lance writer living in Alexandria, Va. In her 25 years of writing, she has covered such diverse topics as the construction industry, health care, higher education, and employment for national trade magazines, medical newsletters, university publications, and the* Washington Post.